The Social Sciences 12 (12): 2212-2217, 2017
ISSN: 1818-5800

The Mathematical Connection Ability in Multiplication Material at the Elementary School

Dyah Worowirastri Ekowati
University of Muhammadiyah, Malang, Indonesia

Abstract: The purpose of the research is to determine the ability of student's mathematical connection in multiplication's material at 2nd grade of Muhammadiyah 9 Elementary School, Malang. Mathematical connection abilities include intervention, negotiation, collaboration and evaluation. The research uses qualitative approach and classroom action research. The data source is in the form of data activity of teachers and students during the learning process and interviews as well as researchers as the main instrument. This research is done in 2 cycles. The results showed that 85% of students have the ability to use multiplication in everyday life and 100% of students are able to connect repeated summation with multiplication understanding.

Key words: Connection, mathematics, multiplication, research, data activity, determine

INTRODUCTION

The basic concept of multiplication that are studied by 2nd grader elementary school students is a foundation for children to perform multiplication operations in a higher grade or to solve problems related to the concept of multiplication (McCrink and Spelke, 2010). When asked about problems that occur in mathematics learning in 3rd grade, one of the 3rd grade Muhammadiyah 9 Elementary School teacher states that 75% of students are having trouble with multiplication. The difficulty was felt by students when they were requested to connect the concept of multiplication that has been learned with everyday issues (Frykholm and Glasson, 2005). Some of 3rd grade students who were interviewed states that when learning multiplication they were asked to memorize a lot of numbers, students cannot connect multiplication with summation form (Zhou *et al*., 2006). When given everyday problem about how many tiles are skipped by Budi if he walked 5 times and in each step he skipped three tiles, students were unable to answer using multiplication concept.

On the other hand, the score of 2nd grade students on multiplication daily tests in the academic year 2012/2013 SD Muhammadiyah 9 Malang showed <100 score, the average score of students is 61 and <70% who reach 65. Another fact that can be found shows that the activity of learning multiplication is still dominated by the teacher using the expository method (Cochran, 2003). Learning tends to be one way communication, students only have little opportunity to connect multiplication material with everyday life. Student's opportunity to negotiate, intervene and collaborate is reduced. Students learning activities are more about receiving explanation from the teacher and doing exercises. Therefore, evaluation that was conducted by the teacher becomes less profound. It is only limited in knowledge alone. In addition, the learning resources that are used are limited to one elementary mathematics textbooks (Opfer and Pedder, 2011). The learning process tends to ask students memorizing as a result they do not understand the definition of multiplication and do not understand the concept of multiplication significantly.

Based on the minister of education and culture of the republic of Indonesia Regulation (Permendikbud RI) No. 67 of 2013, it is known that the basic competencies that must be mastered in the study of numbers in 2nd grade are multiplication and division operations of numbers which value is <100 through exploration activities using concrete objects. In addition to fulfilling the basic competencies that have been set out in the curriculum, the learning process should also meet the standard mathematics content with the standard that are being studied. The standard process capabilities include problem solving, reasoning and proofing, communication, connections and mathematics presentation (Depdiknas, 2005).

By the standards process that has been mentioned above, one of the ability that has to be mastered is the ability to connect. In mathematics from kindergarten through fourth grade elementary school the students is expected to do. One of the hopes of the mathematics connection ability is students familiar with the relationship between different topics in mathematics and using mathematics in everyday life (Garcia *et al*., 2006). Connection capabilities include intervention, negotiation,

collaboration and evaluation (NCTM, 2000). The introduction of the relationship between different topics in mathematics will make students to understand that mathematics is not a collection of separate topics without meaning but facilitating intervention, negotiation, collaboration, evaluation among student. The use of mathematics in everyday life allows students to understand the benefits of math and find that the mathematics is part of human needs and make them motivated to learn.

Mathematics characteristics include abstract nature, agreements and empty symbols of meaning. In the multiplication, the thing that is studied is abstract objects. For example: "3×5 = 15" is the fact that is understood as "three times five equals fifteen". The more complex fact is "3×5 = 5+5+5 = 15" which is understood as "three times five equals five plus five plus five plus five equals fifteen. Almost 90% of students were not sure with the meaning of multiplication as repeated addition. For instance, the meaning of 3×2, the students were not sure that 3×2 is two plus two plus two plus two". Most tend to interpret that 3×2 is three plus three. At the time, it was demonstrated using story problems or using concrete objects, the student can understand and distinguish the meaning of 3×2 with 2×3. This means that in learning multiplication students should know the relationship between addition and multiplication topic (Zhou *et al*., 2006).

Noting the learning conditions and student's ability to learn multiplication in 2nd grade SD Muhammadiyah 9 Malang mentioned above, it is considered important to do this research. In this research, the connections ability that is implied in the multiplication material is the ability to connect repeated summation concept as the definition of multiplication and the ability to use multiplication in everyday life. Student mathematics connections ability criteria are limited in the ability to intervene, negotiate, collaborate, evaluate among students on the multiplication material.

MATERIALS AND METHODS

The approach in this research is qualitative and classroom action research. The research site is 2nd grade SD Muhammadiyah 9 Malang Indonesia. The data source is in the form of teachers and students direct activity data during the learning process and the student's interviews result and researchers as the main instrument.

Analysis of the data used in this study is qualitative and quantitative analysis. This data is analyzed by steps; describe the data, analyze quantitative data in the form of a score and summed the data. The data conclusion is adjusted to the specified criteria. Criteria for success is determined by two criteria: increased students mathematics ability to connect in the form of intervention, negotiation, collaboration and evaluation between the student and the 2nd grade SD Muhammadiyah 9 Malang Indonesia students evaluation in connecting repeated summation with understanding of multiplication and the ability to use multiplication in everyday life obtained from the learning process, to determine the success of the action by using the criteria of mastery learning. If the percentage of the students pass the study >85% which is students who obtain score >65 the action is considered successful.

RESULTS AND DISCUSSION

The learning process is in 2 cycles with two meetings in each cycle. Implementation of learning is based on multiplication lesson plans that had been developed previously (Li *et al*., 2009). In this study, the number of participant is 33 students of 2nd grade SD Muhammadiyah 9 Malang. The basic competence is the multiplication results of two digit numbers. The success indicator of the learning process is that the student can recognize the concept of multiplication, multiplication results of two digit numbers and multiplication tables up to 5, using simple multiplication in everyday life.

The learning experience are given problems associated with widely known event in this case is serving a variety of foods in a birthday party and learn to interact using a birthday cake, the students recognize the concept of multiplication. Students learn multiplication from repeated summation; this is where they learn to connect (NCTM, 2000).

In the scene of birthday party, each student gets 1 box of birthday cake. In each case, each student gets assorted pastries. In the end, each student determines how much of each type of food served on the table in each tray there are same type and equal number of food and it's available in several tray (Nemirovsky *et al*., 2012). Students learning is facilitated by using LKS, students pay attention to a wide variety of food drawing on the table feast (Anderson *et al*., 2000). When receiving LKS there are some students who were scrambling to see it first, the teacher directed them so that the LKS being seen and examined together with their group members. The following figure is an overview of the variety of food at the party (Fig. 1).

After students review or recap their work in the LKS, teachers encouraged students to pay attention to the teacher in front of the class. The teacher wrote on the board 2×3 = 6 and then asked some students to name

Fig. 1: The food at the party

such calculations. Some students who were appointed have mentioned "multiplication". Then, the teacher wrote back on board "there are 3 plates and 4 bread in each plate, so there are 12 breads how to express this statement in the form of multiplication?". Some of the students who were appointed answer "three times four equals twelve". The classroom was then agreed that calculation of "3×4 = 12" is called "multiplication" (McCrink and Spelke, 2010). In this learning process using a birthday party students are also aware of the relevance of daily events which are significant with the concept of multiplication. By being aware of these linkages, it will help students to be able to use multiplication in everyday life (Cooney *et al*., 1988).

Once the concept of multiplication began to be known by students who do the assignments in LKS, teacher further provides more advanced tasks so that students understand the concept of multiplication in everyday life. Students did the LKS assignments in pairs so that they can discuss and work together. During the LKS assignments the teacher observes and provides guidance to the students who need help.

In the next activity several students who were representing their group was asked to write his work of each number that was assigned by the teacher on the board, other students were asked to compare their results of work. The students were enthusiastic to write on the board. This is because there is a reward from the teachers for any student who writes in front of the class, they will receive stationery such as pencil, eraser and sharpener. Out of six students who wrote his work on the board there were two students who didn't write complete answer, FW wrote down the answers of point C number 1 "2×4" the proper answer is "2×4 = 8" then PN wrote down the answers pf point D number 2 "4×3 = 12" the proper answer is "3×4 = 12". After being given the opportunity to compare their work with other students, YG and RA were able to write down the correct answers.

In the final stages of learning, teacher led students to understand better the concept of multiplication by providing form of expressions and asked students to declare it in the form of multiplication. Before closing the session, teacher gave individual homework for students. By giving homework, teacher wants to evaluate whether students have achieved the learning indicators specified in the lesson plan. The teacher closed it with greeting.

Some things are still considered lacking in cycle 1 are in the first cycle learning, students is relatively new to the concept of multiplication and to understand multiplication as repeated summation. Some students who were unable to distinguish between the concepts of 3×2 with 2×3 became acquainted and able to distinguish the concepts. Collaboration and negotiation capabilities of students obtained from data observation shows average results, it means that it should be improved. Based on student evaluation test results 70% of students are able to write repeated summation as multiplication. However, in solving everyday problems 55.76% of students still need to learn about complete multiplication.

Noting the weaknesses above, the second cycle study is designed to provide an opportunity for students to be more familiar with multiplication by completing multiplication tables up to 5 and provide sufficient learning experience to students using multiplication to solve relevant everyday problems. Therefore, the classroom atmosphere designed as party scene as shown in the image (Fig. 2).

Students who have difficulty are students who still focus in individual learning. After further explored, students who learn individually are those who come from families with middle to upper levels income. At this stage, the intervention category of students from the observation showed average score. Therefore, there will be mathematical connection ability and student learning outcomes improvements in the next cycle.

At the beginning of the second cycle learning, the teacher explained again how students will learn mathematics today that is they will be studying in pairs and having more interaction in learning process. If students are facing any difficulties in learning, the teacher requested them to ask her. Teacher started to organize students in pairs in accordance to their academic ability and activeness (Stuyf, 2002).

LKS giving in cycle 1 make students compete and happy this was seen when learning process in cycle 2 began some students request to learn using LKS. Students were completing the multiplication table in

Fig. 2: Party scene

Fig. 3: Student presentations

LKS. At the time of completing LKS, students often asks about their work to the teacher that is why the learning environment often distracted by students who ran up to meet the teacher. For this, the teacher paid more attention to students and visiting students who need help. Next, the teacher asked assigned student to read their results alternately and other students to comment if they find any mistake. When the teacher chose who will represent their group in presentation, all students were enthusiast to perform. Sometimes learning process was not conducive because all students want to perform. Through teacher guidance, students were able to decide their representative for presentation.

Alternately, students representing their group reciting multiplication tables as requested by the teacher. Some students are spontaneously shouting "wrong" when a fellow student read his answer. The teacher asked the student to comment after he finished reading the multiplication table. Enthusiastic and competitive learning atmosphere were shown in the picture (Fig. 3).

In the next stage, after class discussion about multiplication table there was question and answer session between students, groups of students and teachers to negotiate whether the list multiplication just described is correct. By looking back in the multiplication table and asking several students, it was agreed that the multiplication table is correct.

Discussion and teamwork activities in groups to solve everyday problems using multiplication run for 30 min. After that each group representation were asked by the teacher to read their results and other students to respond. By doing the tasks on LKS, students were gaining experience using multiplication in everyday life.

In the final stages of learning, teachers gave students opportunities to read and understand multiplication table that has filled out by students correctly. Students were also directed to recap the use of multiplication in everyday life on task number 5-7 in the LKS. Based on the LKS work results, 33 students were able to connect multiplication as repeated addition. In addition, the party scene was able to foster student's ideas to connect multiplication material in everyday life (Garcia *et al*., 2006). This is supported by the students evaluation tests, 85% of students have multiplication material connection capabilities in everyday life, 100% of students are able to connect multiplication understanding with repeated summation. Supported by research subjects interview results of 6 students who's in average able to do connection in multiplication material. Finally, the research cycle was stopped at second cycle.

An important note given by the observer in students activity is that students are often ask about its work to the teacher so that the learning atmosphere was often distracted by students who ran up to meet the teacher. For this, the teacher paid more attention to students and visiting students who need help. Besides cycle 2 learning process, a test also conducted. The purpose of the second cycle test is to determine the ability of students to use multiplication in daily lives which in the first cycle not all students are able to use this ability correspondent with the outcomes on predetermined category. The ability of students to use multiplication in everyday life is one of focus of this study. Cycle 2 test performed using test instruments that have been developed previously in the form of a brief description. The number of items is 7 and must be done entirely by the students. Scoring the test results refers to the criteria established in the lesson plan.

Cycle 2 test results learning outcome is 95.34 students average score and 100% completion of students. Based on connection capability observation in cycle 2 is

known that the students mathematics connection ability in the form of intervention, negotiation, collaboration and evaluation has increased. In cycle 1, the ability of intervention, negotiation, collaboration and evaluation criteria are average. While in cycle 2 there is an increase in intervention and evaluation capabilities in the good criteria and negotiation and collaboration ability are in the very good criteria. Moreover, 6 student's interviews as research subjects show that students are able to do connection in mathematic multiplication material through birthday party activity, completion of assignments and also presentations. It can be concluded that the research is ended in cycle 2.

Students activities and study group has been going according to lessons plan. Students have intervened, negotiate, collaborate and evaluate in birthday party activity, completion of tasks in LKS and also presentations. Furthermore, the students did the discussion and collaboration activities in completing LKS. In this case show that the LKS is able to direct students to complete their learning bill (Choo *et al*., 2011). Using the LKS, the student's attention is no longer solely focused on teacher, students focused on the completion of tasks.

In the end the students dared to express opinions and blamed others opinion that does not comply with his opinion. Negotiations, collaboration and intervention in the group were able to grow active and enthusiastic atmosphere in the classroom and students to complete the tasks in LKS. Students were more willing to ask and answers questions. LKS usage in learning helped students to work and learn independently with their partner (Pol *et al*., 2010). Giving LKS in learning can also make students happy this was seen when learning process in 2nd cycle began some students immediately requested to learn using LKS.

Some students who were lazy on previous learning when given the opportunity to learn by collaborating with his friend become more active and willing to finish the tasks. Students who on the written tests could not answer correctly when interviewed verbally on the subject could respond correctly. When learning multiplication student's negotiation, collaboration, intervention skills develop very well. Student's ability to evaluate his ability to perform presentation is well developed. In addition, teachers were more active, creatively develop ideas, learning objectives can be achieved and more pleasant learning atmosphere, so that learning process meets the criteria of active creative effective and fun learning. Students activity in learning is better than the previous learning. The birthday party's classroom atmosphere was able to cultivate student's ideas to connect multiplication material with everyday life (Garcia *et al*., 2006; Pol *et al*., 2010). Atmosphere experienced by students were able to improve learning quality so that become meaningful for students. This meaningfulness ultimately improves connection capabilities of students in multiplication material.

CONCLUSION

Noting the research focus, data exposure and analysis and discussion of the research result it can be concluded that 2nd grade students of SD Muhammadiyah 9 Malang Indonesia ability to connect has increased. In cycle 1.70% of students are able to write repeated summation as multiplication. But in solving everyday problems it is only 55.76% of the students are able to do it. Whereas 85% of students have multiplication material connection capabilities in everyday life and 100% of students are able to connect repeated summation with the multiplication understanding. In addition, the ability of connections consisting of negotiation, collaboration, intervention and evaluation in cycle 1 are in average category. In cycle 2 negotiation, collaboration and intervention skills are in very good category whereas evaluation ability is in good category. Atmosphere experienced by students were able to improve learning quality so that become meaningful for students. This meaningfulness ultimately improves connection capabilities of students in multiplication material.

REFERENCES

Anderson, J.R., J.G. Greeno, L.M. Reder and H.A. Simon, 2000. Perspectives on learning, thinking and activity. Educ. Res., 29: 11-13.

Choo, S.S., J.I. Rotgans, E.H. Yew and H.G. Schmidt, 2011. Effect of worksheet scaffolds on student learning in problem-based learning. Adv. Health Sci. Educ., 16: 517-528.

Cochran, S.M., 2003. Learning and unlearning: The education of teacher educators. Teach. Teach. Educ., 19: 5-28.

Cooney, J.B., H.L. Swanson and S.F. Ladd, 1988. Acquisition of mental multiplication skill: Evidence for the transition between counting and retrieval strategies. Cognit. Instruction, 5: 323-345.

Depdiknas, 2005. Guidelines for writing textbooks mathematics. Depdiknas, Jakarta, Indonesia.

Frykholm, J. and G. Glasson, 2005. Connecting science and mathematics instruction: Pedagogical context knowledge for teachers. Sch. Sci. Math., 105: 127-141.

Garcia, F.J., J.G. Perez, L.R. Higueras and M.B. Casabo, 2006. Mathematical modelling as a tool for the connection of school mathematics. ZDM. Intl. J. Math. Educ., 38: 226-246.

Li, Y., X. Chen and G. Kulm, 2009. Mathematics teachers practices and thinking in lesson plan development: A case of teaching fraction division. ZDM. Intl. J. Math. Educ., 41: 717-731.

McCrink, K. and E.S. Spelke, 2010. Core multiplication in childhood. Cognit., 116: 204-216.

NCTM., 2000. Principles and Standards for School Mathematics. 3rd Edn., National Council of Teachers of Mathematics, Reston, VA., ISBN-13: 9780873534802, Pages: 402.

Nemirovsky, R., C. Rasmussen, G. Sweeney and M. Wawro, 2012. When the classroom floor becomes the complex plane: Addition and multiplication as ways of bodily navigation. J. Learn. Sci., 21: 287-323.

Opfer, V.D. and D. Pedder, 2011. Conceptualizing teacher professional learning. Rev. Educ. Res., 81: 376-407.

Pol, V.D.J., M. Volman and J. Beishuizen, 2010. Scaffolding in teacher-student interaction: A decade of research. Educ. Psychol. Rev., 22: 271-296.

Stuyf, V.D.R.R., 2002. Scaffolding as a teaching strategy. Adolesc. Learn. Dev., 52: 5-18.

Zhou, X., C. Chen, Q. Dong, H. Zhang and R. Zhou *et al*., 2006. Event-related potentials of single-digit addition, subtraction and multiplication. Neuropsychol., 44: 2500-2507.